$1.00

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

WARNING

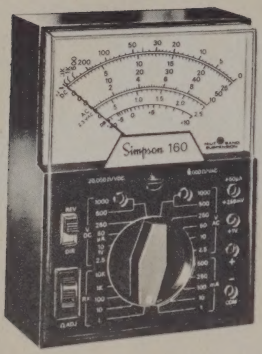
For safety of operator, it is essential that this manual be carefully read before the instrument is used for any measurements.

VOLT—OHM—MILLIAMMETER
MODEL 250

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie St., Chicago, Illinois 60644
Area Code 312, Telephone 379-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

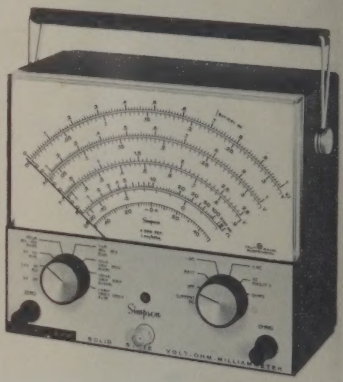
new VOMs from Simpson



160 Handi-VOM

Just 3 5/16" Wide . . .
with Full-Size VOM Features

- 20,000 Ω VDC . . . 5,000 Ω VAC
- ±2% DC . . . ±3% AC
- 5 Resistance Ranges . . . Plus a 0-250 DC Millivolt Range



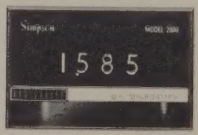
313 Solid-State VOM

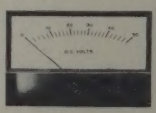
VTVM Features . . . VOM Conveniences

- Uses a single 9-volt battery
- 11 Meg Ω DC . . . 10 Meg Ω AC
- Large 7" scale

Write for Catalog 4100

Simpson has over 1,400 stock sizes and types of panel instruments, too!





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OPERATOR'S MANUAL

VOLT-OHM-MILLIAMMETER
MODEL 250

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie St., Chicago, Illinois 60644
Area Code 312, Telephone 379-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

Simpson Electric Co., Chicago
6-72 JMO HINZ

Printed in USA
5-110451

FIG. 1: SIMPSON VOLT-OHM-MILLIAMMETER — MODEL 250

SECTION I

GENERAL DESCRIPTION

INTRODUCTION

The Simpson Model 250 is a rugged, accurate, compact, easy to operate instrument. It is used to measure electrical characteristics of circuits and circuit components. It is used for measurement of AC and DC voltages, Direct currents, and Resistances.

To complement the circuit accuracy, the tester features the new Simpson taut-band suspension, annular movement. The annular movement is self-shielding, and the taut-band suspension has superior repeatability due to the absence of normal pivot-jewel wear. These basic design improvements result in an instrument which guarantees years of trouble-free service in normal use.

A special calibration circuit is incorporated which yields increased accuracy and facilitates recalibration to original factory accuracy, should it ever be necessary.

The Model 250 utilizes the most modern components and circuit techniques. It is manufactured by skilled workmen using high quality materials, and in modern plants using the best machines, tools, and test equipment. It will, therefore, take considerable abuse and still continue to function. However, it does contain a very precise instrument movement and, therefore, we urge that you treat it with the care it deserves by not subjecting it to severe vibration or to high electrical overloads.

General Description

The Model 250 is housed in a sturdy, black phenolic case. It is molded with reinforced walls for maximum durability. All of the component parts of the tester are attached to the front panel. The entire instrument slips into and out of the case in one piece.

Conforming to the latest engineering developments, most of the component parts are mounted on a printed circuit board. This simplifies assembly, reduces maintenance and extends the useful life of the instrument.

The Adjust-A-Vue handle is attached on each side of the instrument case. The handle may be used to support the instrument in a convenient sloping position for easy viewing on the bench top. Of course, the tester can also be placed in either a vertical or horizontal position.

The Model 250 is furnished with one pair of 4 foot test leads with alligator clips on one end and elbow banana plugs on the other end. One lead is black and the other red for easy polarity identification.

An internal fuse is incorporated which protects the tester from misuse on the ohmmeter ranges and from excessive overload on the milliampere ranges. A special silicon diode protects the meter movement even with 1000 times the current applied.

SPECIFICATIONS

RANGES

D.C. Voltage	(20,000 ohms/volt)	Accuracy (per cent of full scale)
	.050	
	.250	
	2.5	
	10	±2%
	50	
	250	
	500	
	1000	

A.C. Voltage	(5,000 ohms/volt)	
	2.5	
	10	
	50	±3%
	250	
	500	
	1000	

Direct Current	M.V. Drop	Accuracy (per cent of full scale)
50μa	250	±1%
50μa	50	±1%
1MA	50	
10MA	50	
100MA	50	±2%
500MA	50	
10 Amperes	50	

RESISTANCE

			Accuracy (degrees of arc)
Rx1	0-2000 ohms	12 ohm center	2.5°
Rx100	0-200K ohms	1200 ohm center	2.0°
Rx10K	0-20 megohms	120K ohm center	2.0°

VOLUME LEVEL IN DECIBELS

With zero DB equal to 1 milliwatt across a 600 ohm line

−20 to +10 DB
−8 to +22 DB
+6 to +36 DB
+20 to +50 DB

OVER ALL DIMENSIONS 5-1/4" x 7" x 3-1/8"

WEIGHT 3-1/2 lbs.

FREQUENCY RESPONSE

A.C. Voltage Ranges

The Frequency response of the A.C. ranges is essentially flat over the wide range of 20 hertz to 100KHz.

CONTROLS AND CONNECTORS

RANGE SWITCH

The range switch, in the center of the lower part of the front panel, has 12 positions. It may be turned in either direction to obtain any desired range and circuit position.

FUNCTION SWITCH

The function switch is located at the left hand side of the lower part of the front panel. It has three positions: —D.C., +D.C. and A.C. When direct current, D.C. voltage, or resistance is to be measured, the function switch may be set to —D.C. or +D.C., depending upon the polarity of the current or voltage under test. This eliminates any need to reverse the test leads at the test points.

ZERO OHMS

The control at the lower right on the panel is marked ZERO OHMS. This variable resistance in the ohmmeter circuit is used to compensate for the aging of the internal batteries. Use it to adjust the meter indication to zero (at the right end of the upper meter scale) with the test leads shorted together whenever the ohmmeter circuit is used.

CIRCUIT JACKS

There are eight jacks, two being located in each corner of the front panel. These are the connection points for the test leads. Insert the elbow prods of the test leads into the proper jacks to obtain the circuit and range desired for each application.

At the lower left are the COMMON — and + jacks. These are the jacks that will be used most. Insert the black test lead into COMMON — for all circuits and ranges except the D.C. 10 amperes range. Insert the red test lead into the +jack for all circuits and ranges except those designated by the other circuit jacks.

Across the top of the panel are jacks marked 50 μA/50 MV, —10A, +10A, and 50 μA/250 MV.

To use the 50μA or 50 MV range the black test lead is inserted into the COMMON — jack and the red test lead into the 50μA/50MV jack. To use the 50μA or 250MV range transfer the red test lead to the 50μA/250MV jack. To use the 10 AMP. range the black test lead is inserted into the —10 AMP. jack and the red test lead into the + 10 AMP. jack.

In the lower right hand corner of the panel are two jacks marked A.C. 1000V and D.C. 1000V. These jacks are used to measure the A.C. and D.C. voltages to 1000 volts. To use the 1000 volts A.C. range, the red test lead is inserted into the A.C. 1000 V. jack. For the 1000 volts D.C. range, the red test lead is inserted into the D.C. 1000 V. jack.

SECTION II

OPERATING INSTRUCTIONS

CAUTION

When making voltage or current measurements, as a personal protection, form the habit of turning off all power to the circuit under test. Connect the test leads at the desired points in the circuit. Then turn on the power while taking readings. Turn off the power before disconnecting the test leads from the circuit.

SHOCK HAZARD (As defined in Underwriters Laboratories Radio and Television Receiving Appliances Standards for Safety, Eleventh Edition, dated November, 1964.)

"A shock hazard is considered to exist at any part involving

a potential of between 30 volts and 40 kilovolts peak in the following cases:

A. If the current through a load of not less than 500 ohms exceeds 300 milliamperes after 0.0003 second.

B. If the current through a load of not less than 500 ohms exceeds 5 milliamperes after 0.2 second.

C. If the time required for the current through a load of not less than 500 ohms to decrease to 5 milliamperes is between 0.1 and 0.2 second, and the total quantity of electricity passed through the load up to that time exceeds 4 millicoulombs.

D. If the time required for the current through a load of not less than 500 ohms to decrease to 5 milliamperes is between 0.03 and 0.1 second, and to total quantity of electricity passed through the load up to that time exceeds $75T\text{-}350T^2$ millicoulombs, where T is time in seconds.

E. If the potential is more than 5 kilovolts peak and if the total capacitance of the circuit is more than 3000 micro-microfarads."

ADJUST POINTER FOR ZERO

Before any measurements are made, check to see that the pointer indicates zero when the meter is in its operating position. If the pointer is off zero, adjust the screw located in the phenolic case below the center of the meter scale, as shown in Figure 1. Use a small screwdriver to turn this screw slowly clockwise, or counterclockwise, until the pointer is exactly over the zero mark at the left side of the scale.

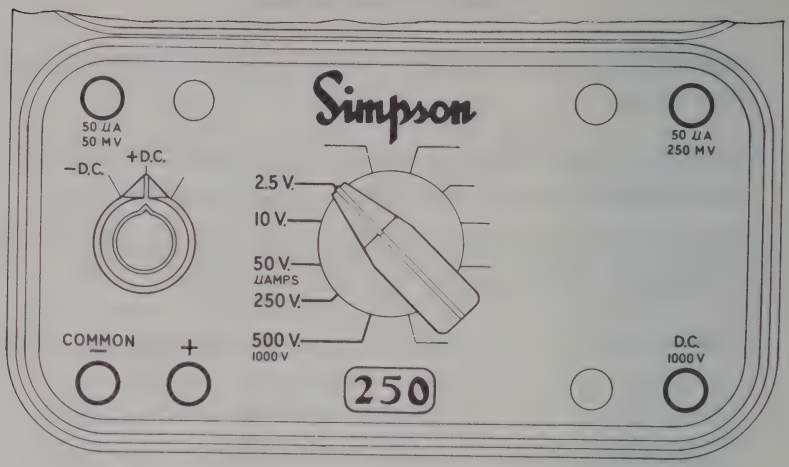

FIG. 2: JACKS AND SWITCH POSITIONS FOR D.C. VOLTS.

D.C. VOLTAGE MEASUREMENTS, 0-50 and 0-250 MILLIVOLT RANGES ONLY

CAUTION

Be extremely careful when using the Model 250 as a millivoltmeter in order to prevent damage to the meter. An excessive voltage applied to the meter when in this type of application can be detrimental to the meter movement.

1. Set the function switch to +D.C.
2. Insert the black test lead into the COMMON — jack. If the voltage to be measured is below 50 millivolts, insert the red lead into the 50μA/50 MV jack or, if the voltage is above 50 millivolts, insert the red lead into the 50 μA/250 MV jack.

3. Set the range switch at 50 μAMPS (Common position with 50V).

4. Connect the black test lead to the negative side of the circuit to be measured, and the red test lead to the positive side of the circuit.

5. Read the voltage on the black arc marked D.C., and use the figures marked 0-50 when the red test lead is in the 50 μA/50 MV jack, and use the figures marked 0-250 when the red test lead is in the 50 μA/250 MV jack; read directly in millivolts.

6. If the meter reads in reverse, turn off the power in the circuit being measured and reverse the polarity of the test leads. The function switch does not reverse the polarity on these ranges.

7. Turn off the power to the circuit being measured before disconnecting the test leads.

D.C. VOLTAGE MEASUREMENTS, 0-500 VOLTS

1. Set the function switch on the left side of the front panel to +D.C.

2. Insert the black test lead into the COMMON — jack and the red test lead into the + jack.

3. Set the range selector switch in any of the five voltage range positions. These are marked 2.5V., 10V., 50V., 250V., and 500V. *When in doubt as to the voltage present, always use the highest voltage range as a protection to the instrument.*

4. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.

5. Turn on the power in the circuit to be tested. If the meter reads in reverse, turn off the power in the circuit which is being tested. Set the function switch at —D.C., and turn on the power again. This will correct the polarity as applied to the meter. Observe the meter reading. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.

6. Read the voltage on the black arc marked D.C. which is second from the top of the dial.

   For the 2.5 V. range use the 0-250 figures and divide by 100.

   For the 10V., 50V., and 250V. ranges read the figures directly on the scale.

   For the 500V. range use the 0-50 figures and multiply by 10.

7. Turn off the power in the circuit being measured before disconnecting meter leads.

D.C. VOLTAGE MEASUREMENTS, 1000 VOLT RANGE

1. Set the function switch to +D.C.

2. Insert the black test lead into the COMMON —jack and the red test lead into the D.C. 1000 V. jack.

3. Set the range selector switch to the 1000 V. position (Common with the 500 V. position).

4. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side of the circuit.

5. Turn on the power in the circuit to be tested. If the pointer deflects to the left of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit which is being tested. Set the function switch at —D.C. and turn on the power again. This will correct the polarity as applied to the meter.

6. Read the voltage on the black arc marked D.C. which is the second from the top of the dial. Use the 0-10 figures and multiply by 100.

7. Turn off the power in the circuit which is being measured before disconnecting the test leads.

MEASURING A.C. VOLTAGES TO 500 VOLTS

The Simpson Volt-Ohm-Milliammeter, Model 250, measures A.C. voltage in terms of the R.M.S. value of a sine wave. This is accomplished by using two germanium diodes in a modified full wave bridge circuit.

1. Set the function switch to A.C.

2. Set the range selector switch in any of the five voltage range positions, marked 2.5 V., 10 V., 50 V., 250 V., and 500 V. *When in doubt as to the voltage present, always use the highest voltage range as a protection to the instrument.*

3. Insert the black test lead into the COMMON —jack and the red test lead into the +jack.

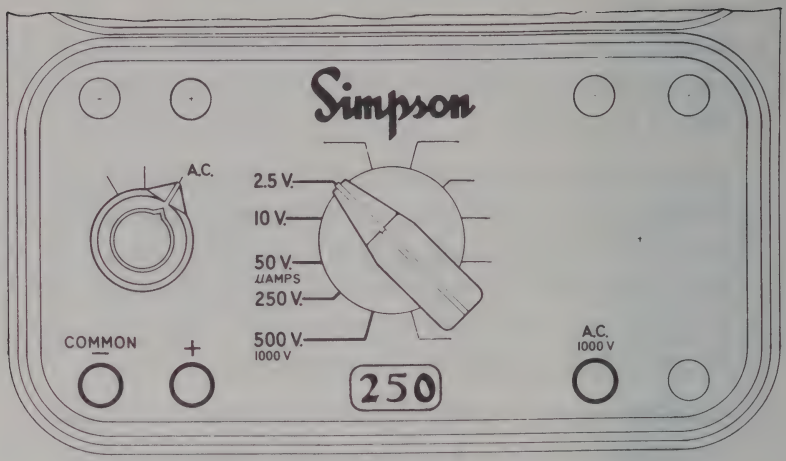

FIG. 3: JACKS AND SWITCH POSITIONS FOR A.C. VOLTS.

4. Be sure power is turned off in the circuit to be measured and connect the test leads across the voltage source.

5. Turn on the power in the circuit to be measured. Observe the meter reading. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.

   For the 0-2.5 V. range, read the value directly on the special arc marked 2.5 V. A.C. ONLY.

   For the 10 V., 50 V., and 250 V. ranges, read the red arc marked A.C. and use the black figures immediately above the arc.

   For the 500 V. range, read the red arc marked A.C. Use the 0-50 figures and multiply by 10.

6. Turn off the power to the circuit being measured before disconnecting the test leads.

MEASURING A.C. VOLTAGES TO 1000 VOLTS

1. Set the function switch to A.C.
2. Set the range selector switch to the 1000 V. position (Common with the 500 V. position).
3. Insert the black test lead into the COMMON —jack and the red test lead into the jack marked A.C. 1000 V.
4. Be sure power is turned off in the circuit to be tested and connect the test leads across the voltage source.
5. Turn on the power in the circuit to be tested. Use the 0-10 figures and the red arc marked A.C. and multiply by 100.
6. Turn off the power to the circuit under test before disconnecting the test leads.

MEASURING AUDIO FREQUENCY VOLTAGES TO 500 VOLTS (OUTPUT METER)

This facility is used whenever it is desired to measure an A.C. voltage which is superimposed on a D.C. voltage, such as the A.C. voltage produced at the plate of an A.F. amplifier.

To measure such a voltage, connect a 0.1 microfarad 600 volt capacitor in series with the red test lead to block the D.C. component. Although the internal impedance of the model 250 is high, an error is introduced by the use of this series capacitor. Actual values may be calculated using the standard impedance formula and applying ohms law.

1. Set the function switch to A.C.
2. Set the range switch to the desired range.

NOTE: If in doubt as to the voltage present, always use the highest range.

3. Insert the black test lead into the COMMON —jack and connect one lead of the 0.1 microfarad capacitor to the +jack, and connect the other end of this capacitor to the red test lead.

4. Connect the black lead to the ground point in the circuit under test and the red lead to the "hot" or above ground point in the circuit and turn the power on.

5. Read the voltage on the red arc marked A.C. using the black figures above the arc.

   For the 2.5 V. range use the 0-2.5 V. A.C. only arc and figures. Read the scale directly.

   For the 10 V., 50 V., and 250 V. ranges, read the figures directly on the A.C. scale.

   For the 500 V. range use the 0-50 figures and multiply by 10.

6. Turn off the power in the circuit under test before disconnecting the test leads.

MEASURING DECIBELS

For some applications, output voltages and audio frequency voltages are frequently measured in terms of decibels. The decibel scale (DB), at the bottom of the dial, is numbered from —20 through 0 to +10.

To measure decibels, read the DB arc after proceeding according to instructions for A.C. or Audio Frequency Voltages.

The DB readings obtained on the 2.5 V. range will be correct

on an absolute scale if you are using a 0 DB power level of .001 watt in 600 ohms, and if the voltage which you read was measured across 600 ohms.

To obtain absolute DB values across 600 ohms on the other ranges.

For the 10 V. range, read the DB arc and add +12 DB to the reading.

For the 50 V. range, read the DB arc and add +26 DB to the reading.

For the 250 V. range, read the DB arc and add +40 DB to the reading.

If the reference level is 0 DB = .006 watt in 500 ohms, subtract 7 DB from the reading to obtain the absolute value of decibels.

ZERO OHMS ADJUST

Each time the ohmmeter circuit is used, check the zero indication on the meter before measuring any resistance. Check and adjust after switching to a different range. To set the ZERO OHMS control, proceed as follows:

1. Set the range switch to one of the resistance range positions and the function switch at either —D.C. or +D.C.
2. Insert the black test lead into the COMMON —jack and the red test lead into the +jack.
3. Clip the contact end of the test leads together to short out the resistance circuit.
4. Observe the meter indication. It should read 0 on the right hand end of the OHMS arc, which is at the top of the dial.

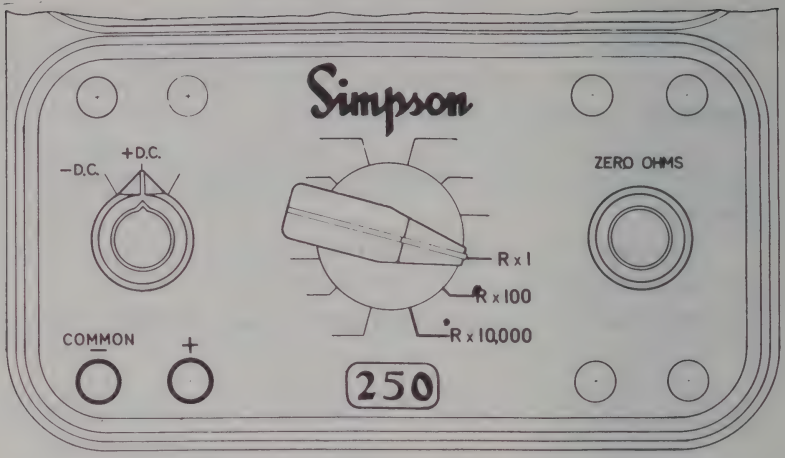

FIG. 4: JACKS AND SWITCH POSITIONS FOR RESISTANCES.

5. If the pointer does not read 0, rotate the ZERO OHMS knob until it does. If the pointer cannot be brought to read 0, one or more batteries need to be replaced.

6. When the pointer shows zero, unclip the shorted test leads. The ohmmeter circuit is now ready to measure resistance.

MEASURING RESISTANCES

NOTE: Before making any resistance measurement, always make sure there is no voltage present across the device whose resistance is to be measured.

To measure resistance, proceed as follows:

1. Set the range switch to one of the resistance range positions.

   Use R × 1 for resistance readings from 0 to 200 ohms. (Short circuit current 125MA. at 1.5 Volts.)

Use R × 100 for resistance readings from 200 to 20,000 ohms.

Use R × 10,000 for resistance readings above 20,000 ohms.

2. Set the function switch to either —D.C. or +D.C.

3. Insert the black test lead into the COMMON —jack and the red test lead into the +jack.

4. Short the test leads together and adjust for zero ohms (See ZERO OHMS ADJUST, Page 17).

5. Separate the test leads and connect them across the resistance which is to be measured. If there is a "forward" and "backward" resistance, such as in rectifiers, switch back and forth between the two D.C. positions of the function switch to reverse the polarity of the voltage which appears at the ends of the test leads.

NOTE

The resistance of such rectifiers will measure different values on different resistance ranges of the Model 250. For instance, a crystal diode which measures 80 ohms on the R × 1 range may measure 300 ohms on the R × 100 range. This is normal and is a result of the diode characteristic. The difference in values does not indicate any fault in the ohmmeter.

6. Read the indication on the OHMS arc at the top of the dial. Note that this arc reads from right to left for increasing values.

7. Multiply the reading by the multiplier factor at the switch position for the resistance value in ohms. "K" on the dial stands for "thousand".

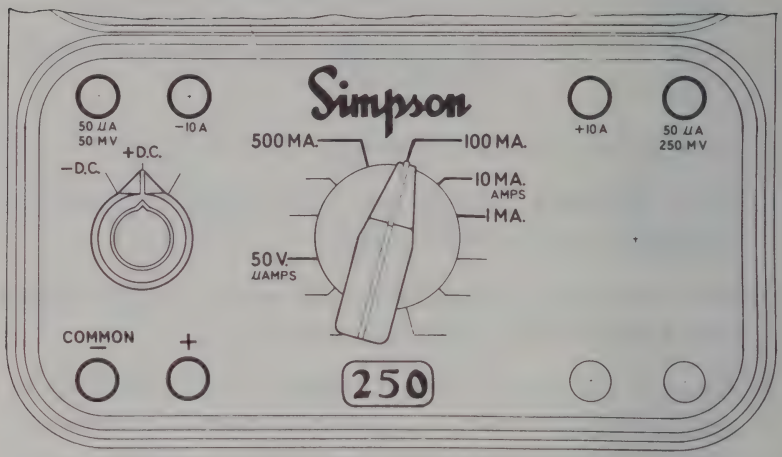

FIG. 5: JACKS AND SWITCH POSITIONS FOR DIRECT CURRENTS.

MEASURING DIRECT CURRENTS, 0 TO 50 MICROAMPERES

CAUTION

Never connect the test leads directly across any voltage when the Model 250 is used as a current meter, except when it is used as a 0 - 50 millivoltmeter or a 0 - 250 millivoltmeter. This will damage the instrument. When making a current measurement, always connect the meter in series with the load.

1. Set the function switch to +D.C.
2. Insert the black test lead into the COMMON —jack and the red test lead into either the 50 μA/50 MV or the 50 μA/250 MV jack, depending on which is desired.
3. Set the range switch at 50 μ AMPS (common position with 50 V.).

4. Open the circuit in which the current is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side, and the black test lead toward the negative side.

5. Turn on the power in the circuit to be measured. Observe the meter. If the pointer is deflected to the left, turn off the power and reverse the leads. Turn on the power again.

6. Read the current directly on the black D.C. arc. Use the 0-50 figures. The current value is shown in microamperes.

7. Turn off the circuit power. Remove the test leads and restore the circuit continuity.

MEASURING DIRECT CURRENTS 0 TO 500 MILLIAMPERES

1. Set the function switch to +D.C.

2. Insert the black test lead into the COMMON —jack and the red test lead into the +jack.

3. Set the range switch in any of the four range positions required. These are marked 1 MA., 10 MA., 100 MA., and 500 MA.

4. Open the circuit which is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side.

5. Turn on the power in the circuit to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, set the function switch to —D.C. and then turn on the power again.

6. Read the current directly on the black D.C. arc.

   For the 1 MA. range, use the 0 - 10 figures and divide by 10.

   For the 10 MA. range, use the 0 - 10 figures directly.

   For the 100 MA. range, read the 0 - 10 figures and multiply by 10.

   For the 500 MA. range, read the 0 - 50 figures and multiply by 10.

   The current values are in milliamperes.

7. Turn off the circuit power. Remove the test leads and restore circuit continuity.

MEASURING DIRECT CURRENT, 0 TO 10 AMPERES

1. Insert the black test lead into the —10 A. jack and the red test lead into the +10 A. jack.

2. Set the range selector switch to AMPS (common with 10 MA.).

3. Open the circuit which is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side.

4. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, reverse the test lead connections, and turn on the power again.

NOTE

The function switch has no effect on polarity for the 10 AMP range.

5. Read the current directly on the black D.C. arc. Use the 0 - 10 figures. The current values are in amperes.

6. Turn off the circuit power. Remove the test leads and restore circuit continuity.

SECTION III

MAINTENANCE

HOW TO OPEN THE CASE

The case is designed to provide easy and quick access for all necessary adjustments and replacement of parts. Use a 1/4-inch screwdriver to remove the four screws in the back of the case. Slip the entire front panel straight forward out of the case. The meter, the front panel, the printed circuit, and the batteries are attached and are removed as a unit.

BATTERY REPLACEMENT

There are five batteries inside the case behind the front panel. They are used to supply power for resistance measurements. One is a large size (Size D) flashlight cell, and the other four are smaller (Size AA) flashlight cells.

When it is no longer possible to bring the meter pointer to 0 for the R×1 and R×100 ranges (see ZERO OHMS ADJUST, page 17), replace the large cell with a fresh one. When it is

no longer possible to bring the pointer to 0 on the R × 10,000 range, replace the four smaller cells with fresh ones. This will restore operation of the ohmmeter circuit.

NOTE: When batteries reach the end of their useful life, they should be replaced promptly. Failure to do so may result in extensive damage to your tester due to battery leakage, even though the battery may be advertised by its manufacturer as "Leakproof".

OBSERVE POLARITY

When you replace the cells, be sure to observe the polarity of the battery circuit. Battery polarity is shown on the panel. The cells are each held in place with specially designed spring clips which also act as battery contacts.

RECTIFIER REPLACEMENT AND RECALIBRATION

There are two small rectifiers located at the top of the printed circuit near the large 1.5 volt cell. These are used to rectify the A.C. voltages for measurement. They are shown as D-1 and D-2 in the overall schematic diagram, Fig. 6.

Both rectifiers act in the meter circuit to effectively create a full wave rectifying action. If either or both should fail, the meter will show incorrect indications.

In case of rectifier failure, replace the defective rectifier with another 1N87G, and be sure to observe polarity when connecting it into the circuit. If a type 1N87G is not available, use any good quality small crystal rectifier as a replacement.

After replacing either or both rectifiers, test the accuracy

of A.C. voltage indications. If necessary, recalibrate the circuit by adjusting rheostats R-28 and R-31 as follows:

1. Set the function switch to A.C. and the range switch to 250 V.

2. Insert the red test lead into the +jack and the black test lead into the COMMON —jack.

3. From a standard voltage source, apply 250 volts A.C. to the red and black test leads. Adjust rheostat R-31 (which is in the upper right corner on the printed circuit board) so the meter reads full scale. Turn power off.

4. Set the range switch to 2.5V. Apply 2.5 volts A.C. to the red and black test leads. Adjust rheostat R-28 (located in the upper left corner on the printed circuit board) so the meter reads full scale. Turn power off.

If no standard voltage supply is available for the above procedure, use this alternate method:

1. Set the function switch to A.C., and the range switch to 2.5V.

2. Insert the red test lead into the jack and the black test lead into the COMMON —jack.

3. Connect the test leads to a fresh 1.5 volt flashlight cell. Connect the red test lead to the positive post of the battery and the black test lead to the negative post.

4. Adjust rheostat R-28 fully clockwise. It is located in the extreme upper left hand corner of the printed circuit board.

5. Rheostat R-31 is located in the upper right hand corner of the printed circuit board. Adjust it so the meter reads 1.8 volts on the 2.5 V. A.C. ONLY arc.

6. Adjust R-28 so the meter pointer moves back to 1.71 volts on the same arc (the pointer will indicate 6 on the OHMS scale when it is in this position).

RESISTOR REPLACEMENT

Almost all of the resistors are mounted on the rear of the printed circuit board and are easily accessible for trouble-shooting and repair.

When it is necessary to replace any of the resistors in the circuit, obtain an exact equivalent resistor. Order from your nearest Simpson Parts Depot and specify the Simpson part number as shown in the parts list. Clip the defective resistor off the printed circuit board, leaving sufficient lead length in the board to be used as connections for the replacement.

Carefully twist the leads of the new resistor around the leads left from the defective resistor and solder each connection. Trim away all excess and see that you have not caused any short circuit to any other part nearby.

REMOVING THE PRINTED CIRCUIT

To service parts located between the printed circuit board and the front panel, remove the printed circuit as follows:

1. Set the function switch to +D.C. and the range switch to 2.5 V.

2. Remove the knob for the ZERO OHMS control.

3. Remove the two screws in the lower part of the printed circuit board.

4. Remove the two hex nuts from the meter studs on the top of the printed circuit board.

5. Carefully pry out the battery contact at the + terminal for the small 1.5 volt cell, and the battery contact to (—) side of the large 1.5 V. battery.

6. Lift the printed circuit board away from the front panel. The entire board, with the switch wafers in place, will come up in one piece.

7. After removal, do not turn knobs on front panel or move any rotors on switches until reassembled.

FUSE REPLACEMENT

Remove the front panel from the case and disconnect the burned-out fuse using a small (60-watt or less) soldering iron. Replace with a 1 amp, 250 volt pigtail fuse, type 3AG or equivalent only.

PARTS LIST

Reference Symbol	Description	Simpson Part No.
R1	Resistor, 1138 ohms	1-113372
R2	Resistor, 110 ohms	1-113373
R3	Resistor, 21,850 ohms	1-113369
R4	Resistor, 117,700 ohms	1-113367
R5	Resistor, 47.6 ohms (bobbin)	10-675263

Reference Symbol	Description	Simpson Part No.
R6	Resistor, 37,500 ohms	1-113393
R7	Resistor, 200,000 ohms	1-113365
R8	Resistor, 800,000 ohms	1-113363
R9	Resistor, 1.25 megohms	5-115068
R10	Resistor, 49,000 ohms	5-110388
R11	Resistor, 910 ohms	5-110456
R12	Resistor, 150,000 ohms	1-113366
R13	Resistor, 1 megohm	1-113392
R14	Resistor, 4 megohms	1-113362
R15	Resistor, 5 megohms	5-110454
R16	Resistor, 11.2 ohms (bobbin)	10-805073
R17	Resistor, .095 ohms Shunt Assy. 500 MA	5-110393
R18	Resistor, 4.5 ohms (bobbin)	10-675264
R19	Resistor, .402 ohms (bobbin)	10-675265
R20	Resistor, 10 megohms	5-110453
R21	Resistor, 2.5 megohms	1-117904
R22	Resistor, .005 ohms Shunt Assy. (10 Amp)	5-110459
R23	Resistor, 3900 ohms	1-110723
R24	Resistor, 4000 ohms	5-110390
R25	Potentiometer, 10,000 ohms ±30%	5-110295
R26	Resistor, 7,500 ohms	1-113370
R27	Rheostat, 350 ohms ± 10%	5-110457
R28	Rheostat, 5000 ohms ± 10%	1-116254
R29	Resistor, 5000 ohms	1-113425
R30	Resistor, 5000 ohms	1-113425

Reference Symbol	Description	Simpson Part No.
R31	Rheostat, 5000 ohms ± 10%	1-116254
R32	Potentiometer, 50,000 ohms ± 20%	5-110458
D1	Diode, Germanium	1-115970
D2	Diode, Germanium	1-115970
D3	Varistor, Silicon	1-110670
F1	Fuse, 1 amp, 250 V., Pigtail Type 3AG or equivalent	1-117702
	Meter Assembly	15-302250
	Test Lead Set (one red and one black)	7500
	Phenolic Case (less handle)	3-320141
	Carrying Handle Assembly	10-860158
	Knobs, for Function Switch	1-115789
	For Range Switch (less set screw)	3-260180
	For Zero Ohms Adjust	1-115790
	Set Screw (for knob 3-260180)	1-114178
	Battery 1.5 V., Size D	1-111798
	Battery 1.5 V., Size AA	1-111802
	Cover Assembly (This includes cover glass glazed into phenolic frame and associated hardware.)	0-005572

ACCESSORIES AVAILABLE

Carrying Case . . . . . Simpson No. 1818
Carrying Case (Ever-Redy) . . . . . Simpson No. 0805
Roll Top Safety Case . . . . . Simpson No. 0249
Carrying Case . . . . . Simpson No. 0549

Snap on Pouch for High Voltage
Probes . . . . . Simpson No. 0574

SECTION IV

ACCESSORY PROBES

A.C. HIGH VOLTAGE PROBE
(5000 ohms per volt)

10,000 volts A.C. . . . . No. 0161

D.C. HIGH VOLTAGE PROBES
(20,000 ohms per volt)

10,000 volts D.C. . . . . No. 0507
25,000 volts D.C. . . . . No. 0508
50,000 volts D.C. . . . . No. 0509

GENERAL DESCRIPTION

These D.C. high voltage probes extend the range of a 20,000 ohms per volt multimeter in a safe, convenient manner at nominal cost. Their primary purpose is to provide effective measurement of terminal potentials of very high voltage, very low power capacity, direct current sources such as anode supplies used in television receivers and other cathode ray tube circuits.

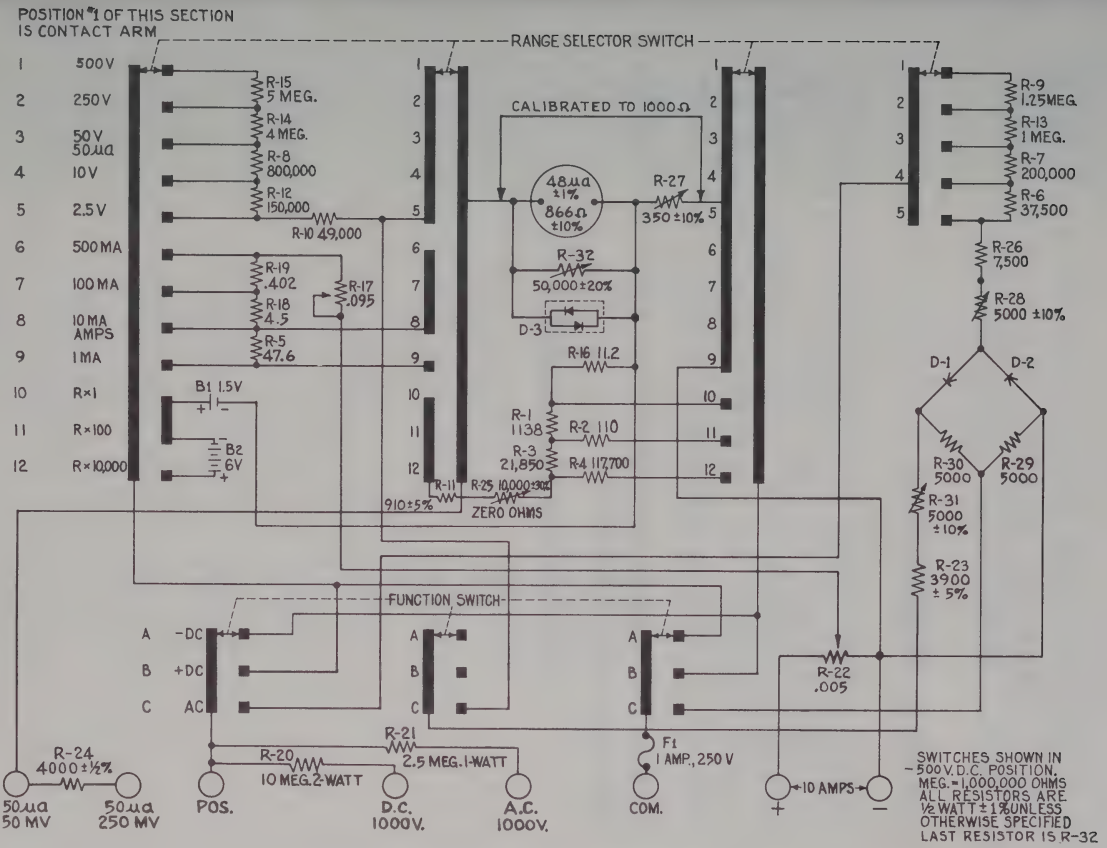

FIG. 6: SCHEMATIC DIAGRAM SIMPSON V.O.M. MODEL 250

The probe body is made of high temperature polystyrene in order to provide high dielectric strength and low leakage. It contains a high resistance precision resistor.

ELECTRICAL SPECIFICATIONS

These D.C. high voltage probes are designed for use with any 20,000 ohms per volt tester having a 2.5 volt D.C. range and scale graduations from 0 - 10 or multiple thereof for the 10 K V probe, 0 - 25 or multiples thereof for the 25 K V probe, and 0 - 50 or multiples thereof for the 50 K V probe.

The D.C. high voltage test probes are available from leading electronics parts distributors.

Accuracy: Probe resistance $\pm$ 2%.

SIMPSON ELECTRIC COMPANY

AUTHORIZED SALES SERVICE CENTERS

* AUTHORIZED PARTS SALES

** PARTS, GENERAL TEST EQUIPMENT & PANEL INSTRUMENT SALES & SERVICE

*** SAME SERVICE as (**) above PLUS AUTHORIZED PANEL INSTRUMENT MODIFICATION

***	Alabama, Huntsville 35805 Brownell–Electro Inc. 106 Jordan Lane N.W.	Area Code 205 536-2451
***	Mobile, Alabama 36617 Brownell–Electro Inc. 3450 Armour Drive	Area Code 205 479-5405
***	Alaska, Anchorage R. M. Zook & Associates 1710 East 27th Avenue	Area Code 907 272-6917
***	Arizona, Phoenix 85034 Metermaster/Phoenix 2633 East Buckeye	Area Code 602 273-7331
***	California, Glendale 91201 R. V. Weatherford Company 6921 San Fernando Road	Area Code 213 849-3451
***	California, Los Angeles 90040 Metermaster, Inc. 5646 Jillson Street	Area Code 213 685-4340
***	California, Palo Alto 94303 Metermaster, Inc. 3969 East Bayshore Road	Area Code 415 968-6292
***	California, San Diego 92123 Metermaster/San Diego 8797 Balboa Avenue	Area Code 714 278-2112
***	California, San Francisco 94105 Pacific Electrical Institute 111 Main Street	Area Code 415 421-7185
***	Colorado, Denver 80223 Meter Master Instrument Corporation 1165 South Cherokee	Area Code 303 722-5766
***	Connecticut, Middletown 06457 The Mancib Company Randolph Road and Coe	Area Code 203 347-5629
**	Connecticut, New Haven 06511 Kaufman Instrument Lab 810 Dixwell Avenue	Area Code 203 776-7201
**	Florida, Miami 33136 Florida Precision Instrument Co. 800 N.W. 7th Avenue	Area Code 305 374-1731
***	Florida, Orlando 32806 Brownell-Electro Inc. 307-27th Street Box 8945	Area Code 305 843-6770
***	Georgia, Hapeville 30054 Brownell–Electro Inc. P.O. Box 82760	Area Code 404 762-5181
**	Hawaii, Honolulu 96819 Electronic Measurement Corp. 2979 Ualena Street	Tel. 847-1138

* * Illinois, Chicago 60648 A & M Instrument, Inc. 6251 West Touhy	Area Code 312 774-3500
* * Illinois, Oak Park 60302 Pacific Indicator Company 6603 West North Avenue	Area Code 312 261-1330
* * Indiana, Indianapolis 46204 Turner Electronics 18 South New Jersey Street	Area Code 317 639-9169
* * Kansas, Shawnee Mission 66205 Sturtz Instrument 4705 Mission Road	Area Code 913 236-4705
* * Kansas, Wichita 67211 Main Electronics, Inc. 363 Pattie	Area Code 316 267-3581
* * Louisiana, New Orleans 70115 Industrial Instrument Works 3305 Tchoupitoulas Street	Area Code 504 895-5621
* * Maryland, Elkridge 21227 Sunshine Scientific Instrument 5600 Main Street	Area Code 301 796-5600
* * Maryland, Timonium 21093 E.I.L. Instrument Division 1830 York Road	Area Code 301 252-1260
* * Massachusetts, Burlington 01803 The Mancib Company Middlesex Turnpike at "A"	Area Code 617 272-9450
* * Massachusetts, Needham Heights 02194 Instruments, Inc. 570 Hillside Avenue	Area Code 617 444-9410
* * Michigan, Ferndale 48220 Ram Meter, Inc. 1100 Hilton Road	Area Code 313 547-1000
* * Minnesota, Minneapolis 55427 Instrumentation Services 957 Winnetka Avenue North	Area Code 612 544-8916
* * Missouri, St. Louis 63143 Scherrer Instruments, Inc. 7170 Manchester	Area Code 314 644-5362
* * Billings, Montana 59102 Industrial Electronics and Automation Company 2442 Grand Avenue	Area Code 406 656-1313
* * New Jersey, Belleville 07109 Marshall Instruments Inc. 236 Washington Avenue	Area Code 201 751-1190
* * New Jersey, Roselle 07203 Brownell–Electro, Inc. 205 Columbus Avenue	Area Code 201 241-8282

* * New York, Buffalo 14216. Area Code 716
Trott Electronics, Inc. 876-0880
Electrical Instrument Labs, Div.
932 Hertel Avenue

* * New York, Great Neck, L.I. 11022 Area Code 516
A & M Instrument, Inc. 487-0330
Community Drive

* New York, Great Neck, L.I. 11022 Area Code 212
Simpson Instrument Sls& Service Inc. 683-0674
130 Cutter Mill Road (516) 482-3103

* * New York, New York 10013 Area Code 212
Nilsson Electronic Lab., Inc. WA5-1730
103 Lafayette Street

* * New York, New York 10011 Area Code 212
Brownell–Electro Inc. 675-2400
85th Tenth Avenue

* * Rochester, New York 14623 Area Code 716
Trott Electronics Inc. 473-8010
30 Ridgeland Road

* New York, Syracuse 13215 Area Code 315
Syracuse Instrument Lab. 492-1651
4895 South Avenue

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* New York, Vestal 13850 Area Code 607
Compton Industries 729-9221
413 Commerce Way

* * North Carolina, Charlotte 28214 Area Code 704
Brownell-Electro Inc. 394-4341
5141 Belhaven Blvd. Box # 8291

* * Ohio, Cleveland 44105 Area Code 216
Pioneer/Cleveland - Instrument Lab. 587-3600
Div. of Pioneer-Standard
Electronics, Inc.
4800 East 131th Street

* * Ohio, Cleveland 44135 Area Code 216
Weschler Electric Corporation 251-4609
4250 West 130th Street

* Columbus, Ohio 43219 Area Code 614
Contronics, Inc. 471-6466
2629 Johnstown Road

* * Ohio, Dayton 45404 Area Code 513
Pioneer-Dayton 236-9900
Div. of Pioneer Standard Electronics,Inc.
1900 Troy Street

* Oklahoma, Tulsa 74120 Area Code 918
Agra Engineering Company 582-5754
551 South Quaker Ave.

* Oregon, Portland 97217 Area Code 503
Westcon, Inc. 285-6629
1910 North Killingsworth Street

* *	Pennsylvania, Philadelphia 19115 Sunshine Scientific Inst. 1810 Grant Avenue	Area Code 215 673-5600
* *	Pennsylvania, Pittsburg 15222 Cameradio Company 2801 Liberty Avenue	Area Code 412 391-7400
* *	Pennsylvania, Pittsburgh 15234 Charles Automatic Controls P. O. Box 10322	Area Code 412 561-6488
* *	Pennsylvania, Pittsburgh (Plum Boro) 15239 E.I.L. Instruments, Inc. 2366 Holliday Park, Route 286	Area Code 412 327-4450
* *	Tennessee, Memphis 38112 Brownell–Electro Inc. 217 Cumberland Street	Area Code 901 323-8554
* *	Tennessee, Memphis 38104 Instrument Repair Service 1378 Overton Park Avenue	Area Code 901 278-0762
* *	Texas, Dallas 75220 Ultra Instrument Lab Inc. 9995 Monroe	Area Code 214 357-0297
* *	Texas, Garland 75040 Metermaster, Inc. 2815 National Drive	Area Code 214 271-2471
* *	Texas, Houston 77006 Electrical Instrument & Meter Co. 1602 Missouri	Area Code 713 526-6871 & 72
* *	Texas, Odessa 79760 Meter Service & Supply 2127 Kernit Hwy P.O. Box 2373	Area Code 915 332-0565
* *	Virginia, Falls Church 22046 E.I.L. Instruments, Inc. 121 Annadale Road	Area Code 703 532-0166
*	Virginia, Richmond 23224 Instrument Technical Reps. 925 East 4th Street	Area Code 703 231-3035
* *	Washington, Seattle 98105 Eicher Richards 2727 N.E. Blakely	Area Code 206 523-7888
* *	Washington, Seattle 98119 The Instrument Lab Inc. 934 Elliott Avenue West	Area Code 206 283-5850
* *	Spokane, Washington 99202 Industrial Instrument Supply Inc. E. 2121 Riverside	Area Code 509 534–9353
* *	Wisconsin, Milwaukee 53202 The Electro–Mechano Co. 241 East Eric Street	Area Code 414 272-4050

Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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AGM DIVISION

Quality is the indispensable component of every Simpson instrument . . . . . .